

## Construction of a resting high fidelity ECG “SuperScore” for management and screening of heart disease

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**QUESTION.** Resting conventional ECG is notoriously insensitive for detecting coronary artery disease (CAD) and only nominally useful in screening for cardiomyopathy (CM). Similarly, conventional exercise stress test ECG is both time- and labor-consuming and its accuracy in identifying CAD is suboptimal for use in population screening. We retrospectively investigated the accuracy of several advanced resting electrocardiographic (ECG) parameters, both alone and in combination, for detecting CAD and cardiomyopathy (CM).

**METHOD USED.** One-hundred fourteen individuals (38 with ischemic or dilated CM, 38 with catheterization-proven CAD but without CM, and 38 age-/gender-matched healthy controls) underwent ~5-min advanced resting 12-lead high-fidelity ECG tests. Multiple conventional ECG parameters were studied for their accuracy in detecting underlying heart disease as were several advanced resting ECG parameters within the following four general categories: 1) 12-lead high frequency (HF) QRS ECG; 2) 12-lead T-wave morphology via singular value decomposition; 3) 12-lead beat-to-beat QT interval variability; and 4) heart rate variability (HRV)

**RESULTS.** A resting 12-lead ECG “SuperScore” that statistically combined those advanced ECG parameters having the largest individual areas under the receiver operating characteristic (ROC) curves in each of the four above categories was retrospectively > 90% sensitive for identifying both CM and CAD while maintaining >90% specificity in identifying asymptomatic controls. The key parameters in this “SuperScore” included the QT variability index derived from the first eigenvector (a virtual lead constructed from singular value decomposition of the 12-lead ECG); the 12-lead HF QRS reduced amplitude zone (RAZ) score; the natural log of the low frequency spectral power of HRV; and the principal component analysis (PCA) ratio of the T wave.

**CONCLUSION.** Resting 12-lead high-fidelity ECG employing and combining the results of several advanced ECG software techniques shows great promise as a rapid and inexpensive tool for screening of heart disease.